Centennial Watershed State Forest

Wangum Lake Block Forest Management Plan

Forest Ecosystem Health & Diversity

The Wangum Lake Block has diverse forest ecosystems of northern hardwoods, hemlock, white pine, and red maple bottomlands that protect the watershed of Wangum Lake, the drinking water supply for the Town of Norfolk.

Climate Change Mitigation through Sequestration and Storage

The management of the Wangum Lake Block will promote carbon sequestration and storage. Sustainable forest management can maintain or enhance forest carbon sinks by transferring carbon to wood products, allowing carbon to be stored over the long-term and substituting for more emissions-intensive products such as concrete and steel.

Economic Benefits

This plan outlines timber harvesting on 232 acres. These sustainably harvested forest products provide jobs and raw material for a locally-sourced, forest-based, green economy. *"Growing What We Need, Where We Live".*

Forest Protection

This plan addresses threats such as exotic invasive plants, insects, and pathogens, as well as unauthorized off-road vehicular use. It makes recommendations to mitigate these damaging agents. The plan recognizes that forests are dynamic and that weather events, insect or disease outbreaks, or other unforeseen conditions may require changes in the recommendations.

Wildlife Habitat

The Wangum Lake Block provides high quality forested habitat with limited fragmentation. It is part of almost 10,000 acres of permanently protected land in this area.

Recreational/Health Benefits

The Blue Trail runs along Old Town Road for about 7,800 feet before continuing into Housatonic State Forest. However, Class 1and 2 lands in the watershed of Wangum Lake are not open to the public.

Environmental Protection

The Wangum Lake Block is managed in partnership with the Aquarion Water Company and The Nature Conservancy. The forest acts as a filter to provide high quality drinking water. The complex canopy structure that will result from the forest management activities in this plan will delay peak storm flows and will minimize nutrients, sediment, and pollutants from entering the water system.

Connecticut is the 14th most forested state with approximately 60% forested cover. It is also the 4th most-densely populated. These two factors create a unique and challenging environment to develop meaningful and effective resource management strategies that will meet the needs of its citizens while protecting and enhancing its natural and ecological resources.

The 2020 Connecticut Forest Action plan was developed to address these needs with input provided by the DEEP, its partners, and various user groups. The plan provides guidance to implement broad statewide forest management strategies based on three national priorities:

1. Conserve and manage working forest landscapes for multiple values and uses;
2. Protect forests from threats;
3. Enhance public benefits from trees and forests.

The following objectives were considered in developing the Management Plan for the Wangum Lake Block of Centennial Watershed State Forest.

1. **Forest Ecosystem Health and Diversity** – Healthy and diverse forest ecosystems provide highly functional, valuable, and a resilient mix of habitats for plants and animals.
2. **Wildlife Habitat** – Many of Connecticut's wildlife species, both common and rare, use a wide variety of forested habitats. It is important to provide many kinds of forested habitats for animals that have different needs.
3. **Climate Change Mitigation through Sequestration and Storage** – Connecticut's State Forests can help mitigate climate change by sequestering and storing carbon in vegetation above and below ground and as durable wood products used locally and beyond.
4. **Environmental Protection** – Connecticut's State Forests provide environmental benefits such as cleaning the air, protecting water quality, and contributing to soil health.
5. **Recreational/Health Benefits** – Connecticut's State Forests provide many recreational opportunities, providing a local and economical way to stay healthy and active.
6. **Economic Benefits** – Sustainably harvesting forest products like timber, firewood, witch-hazel, and maple syrup from Connecticut's State Forests provide jobs and goods that are sold in the local economy. The State Forests are a model for private forest landowners to consider when managing their own properties.
7. **Forest Protection** – Managing Connecticut's State Forests helps reduce susceptibility to threats such as wildfire, weather events, and invasive plants and insects, allowing them to remain healthy and productive.

DEEP welcomes questions and comments regarding the management of the State Forests. The Division of Forestry may be contacted by email at deep.forestry@ct.gov or by phone at 860-424-3630.

STATE OF CONNECTICUT
DEPARTMENT OF ENERGY AND ENVIRONMENTAL PROTECTION

Bureau of Natural Resources
Division of Forestry

FOREST MANAGEMENT PLAN
2021

Wangum Lake Block
Centennial Watershed State Forest

1,242 Acres
Canaan, Connecticut

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Contents

A. Executive Summary

1. The Wangum Lake Block of Centennial Watershed State Forest consists of 1,242 acres, including the 180-acre Wangum Lake. The Block is located in Litchfield County, in the northeastern part of Canaan, adjacent to the Norfolk town line. It is bordered by Housatonic State Forest along much of the north, east, and west boundaries and Great Mountain Forest to the south. The Block includes the watershed of Wangum Lake. The Lake is owned by Aquarion Water Company. It is the drinking water reservoir for the Town of Norfolk.

2. The Block is adjacent to roughly 3,200 acres of Housatonic State Forest, including the Canaan Mountain Wilderness Natural Area Preserve. Combined with the nearby privately-owned Great Mountain Forest, there are about 10,000 acres of permanently protected woodlands in this region. This is the most remote place in Connecticut. Supposedly, the interior of this area is the farthest distance from a road in Connecticut.

3. 913 acres of the Forest will eventually be managed on either an uneven-aged system using 20-year cutting cycles or an even-aged system using a 100-year cutting rotation. This plan recommends 232 acres for a selection harvest. This includes a presalvage of ash on 43 acres in Stand 1-1 in anticipation of the Emerald Ash Borer infesting the area.

4. Exotic invasive shrubs such as Japanese barberry, Oriental bittersweet, multiflora rose, and winged euonymous form a dense understory in Stands 1-55, 1-1, 1-8, 1-43, and 1-44. These invasive plants will need to be killed before opening up the canopy with forestry operations. This will be a multi-year project.

5. Old Town Road, discontinued by the Town of Canaan in 1909, is heavily rutted and eroded from illegal 4-Wheel Drive and ATV use. The road needs to be improved with gravel and a gate installed at the entrance to control access. The Iron Trail, a Blue-Blazed trail, also follows the path of this road. The owners of a cabin on private property (see Map E-Special Features) use this road to access their building. Aquarion Water Company did not give them an easement to use the road. Property Management needs to determine if they have a right to use this road now that the State owns both sides of it.

6. A 29-acre area (Stand 1-32) with “old forest” characteristics (many large, moss-covered downed trees) will be considered an Old Forest Management Site. It will not be actively managed.

B. History

1. **Reason for acquisition and funding sources:** The Wangum Lake Block of Centennial Watershed State Forest was created in 2002 when the State of Connecticut Department of Environmental Protection (now called Department of Energy and Environmental Protection – DEEP) and The Nature Conservancy (TNC) purchased land and conservation easements from the Bridgeport Hydraulic Company (now Aquarion Water Company, or AWC). The agreement, funded by $80,000,000 from DEEP and

$10,000,000 by TNC, preserved approximately 15,300 acres of watershed lands, primarily in Fairfield County. Management is overseen by the Conservation Land Committee (CLC), a cooperative partnership of foresters and land management professionals representing DEEP, AWC, and TNC.

On September 16, 2004, Governor M. Jodi Rell officially designated the land as "Centennial Watershed State Forest" to recognize its importance in protecting drinking water supplies and to commemorate the 100th anniversary of the State Forest system in Connecticut.

The Natural Resources Management Agreement (NRMA) was signed by all three entities. It governs how the land is managed, stating the goals for science-based stewardship of this property as follows:

- Permanently preserve open space
- Protect and provide a safe, reliable, and adequate water supply,
- Promote a healthy, diverse, and resilient forest capable of providing forest products, clean air, plant and animal habitats, recreational opportunities, and aesthetics,
- Maintain significant tracts of naturally occurring, mature, diverse, and continuous forest cover,
- Provide opportunities for public use consistent with the above goals.

Land owned by water companies is regulated by State Statute (CGS25-73c). Land is classified as Class I, II, and III. Class I and II lands are within the watershed of a drinking water supply reservoir while Class III lands are outside the watershed. In Centennial Watershed State Forest, AWC owns the Class I land and the parcels (called "carve-outs") that are occupied by facilities and buildings. The Class I land includes the reservoir and a roughly 250' strip of land that surrounds it. DEEP owns the Class II and III land.

Because usually the Class I and II lands are intermingled on the landscape to such an extent that they cannot be easily delineated on the ground, the NRMA stated that they will be managed as one entity, regardless of ownership. Revenues from forest management activities on Class I and II lands are shared by AWC, DEEP, and TNC in proportion to their fee ownership of the entire Centennial Watershed State Forest, not just in this Block. It breaks down to 62% to AWC, 35% to DEEP, and 3% to TNC.

Development of resource before and after acquisition: In the 1800s, the forests were repeatedly clearcut to produce charcoal for the iron industry. Hemlocks were felled to produce bark for local tanneries, which utilized the tannins.

In 1896, the Town of Norfolk installed a system to deliver drinking water from Wangum Lake to the center of town. BHC acquired the land from the Norfolk Water Department in 1962.

BHC conducted timber harvests in 2001 and 2002, including a mixed hardwood thinning and a red pine salvage/white pine thinning. No management plans were in effect when the State of Connecticut acquired the land.

Properly managed forests can act as an unmatched biological filter to provide high quality drinking

water. Healthy, productive forests with identifiable overstory, midstory, understory, and ground cover provide multiple opportunities for mitigating the kinetic energy of rainfall. Multiple layers of vegetation slow down the rate at which raindrops hit the forest floor, causing less erosion of forest soils. The complex canopy structure intercepts rain and snow, delaying storm peak flows, as well as filtering pollutants in the air by leaf surface area. Retaining a healthy, forested buffer on lands surrounding reservoirs and their tributaries is essential to maintaining a quality drinking water supply. Without this protective, natural filter, large amounts of nutrients, sediment, and pollutants can easily wash into the water system during heavy rain and snow melts.

Forests that are low in species diversity are at greater susceptibility of mortality than a mixed-species forest when a species-specific pest arrives (e.g. Gypsy moth in an oak-dominated forest). Similarly, a forest that is primarily composed of mature trees will be more susceptible to wind damage than a forest of mixed heights and ages. In the event of a large-scale disturbance, such as an ice storm or hurricane, a forest that has a mosaic of stands with different age structures and species will be more likely to avoid damage than a homogenously structured forest. When large-scale disturbances occur within a forest, there can be a flux of nutrients and sediments that are leached into the water system, negatively impacting water quality. Maintaining a heterogeneous, complex forest structure of varying ages and species will form a protective forest cover, serve as a biological filter, and be more resilient to various disturbances.

C. Acres and Access

Acres: The Wangum Lake Block encompasses 1,242 acres, including the 180-acre reservoir.

Table 1.

Land Cover	Acres
Forest	964
Field	4
Wetland	94
Total	**1062**

NOTE: *The GIS layers for Class 1, Class 2, and Class 3 land, the DEEP Property Layer, and information from recently surveyed parcels sometimes do not match. This is particularly evident in the northwestern part of the Wangum Lake Block where it adjoins Housatonic State Forest. These acreages are based on the best available information.*

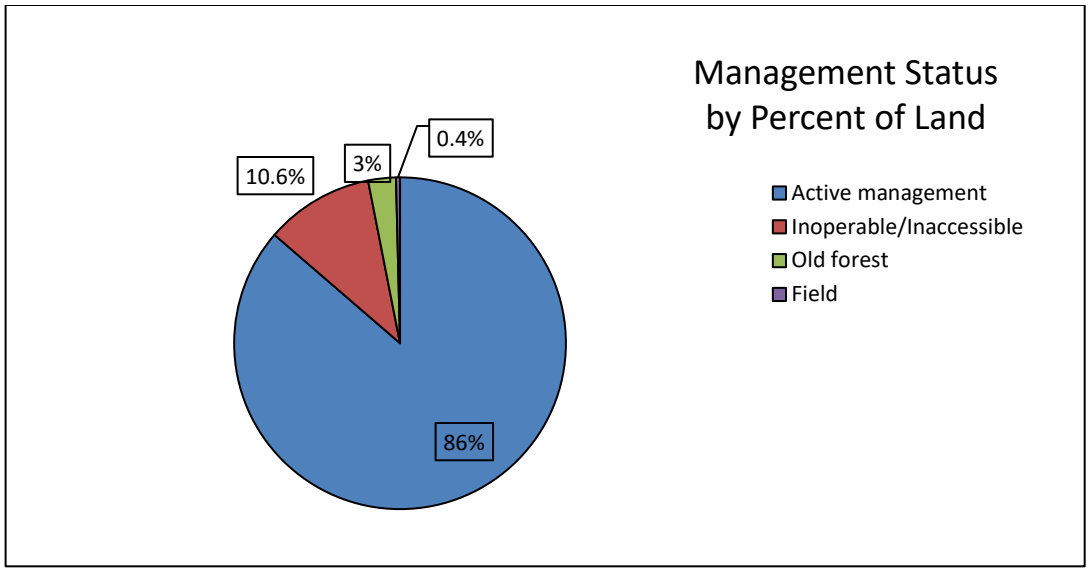

Figure 1.
The pie chart above illustrates the forest as it exists today. The category labeled "Active" is forestland that will be actively managed for timber resources and will enhance wildlife habitat. "Inoperable" land contains physical features such as steep slopes, excessively rocky terrain, or wetlands that prevent active management. "Inaccessible" areas are stands that cannot be reached because of the deterioration of forest roads, no present access, or inoperable conditions (e.g. wetlands). The "Inactive" category refers to land that is not considered forest (e.g. water bodies, aqueducts, and rights of way).

1. **Present access (roads):** Old Town Road, a dirt road that begins at the intersection of Wangum Road and Canaan Mountain Road, runs for 5,700 feet northward along the western end of the Block. A farm gate is at the entrance. Most of Old Town Road has been severely torn up by off road vehicles and is not drivable with 2-wheel drive trucks. Boulders that had been placed to block access around the gate had been moved by vandals. Currently, the boulders are in place.

   According to the survey notes when the State acquired the portion of Housatonic State Forest where Old Town Road originates, the Town of Canaan discontinued the road in Nov. 20, 1909. As a result, ownership of the road reverted to the landowners on both sides of the road, which is now the State.

   A 1,200-foot gravel road leads to AWC's water treatment plant on the eastern side of Wangum Lake. The road is gated. The road continues past the plant for 500 feet before connecting with a logging trail that enters the forest. There is a new chain link gate at this entrance.

   All roads are closed to the public for motor vehicle use.

2. **Inaccessible areas (acres) and access potential**: All portions of the Block are potentially accessible. However, 106 acres are inoperable swamps or oak ridge.

3. **Rights-of-Way:** There is an aqueduct or drainage that runs along the northern edge of stands 1-16, 1-12, and 1-15 that is approximately 10 feet deep and 20-30 feet across. Originally it was built to transport water but it is no longer used.

   Owners of a private inholding north of the Block use Old Town Road to access their hunting cabin. This usage started when Bridgeport Hydraulic owned the property. Now that the State owns both sides of the road, it is not known if they have a legal right to use it. There is no written easement granted to them for access. The Division of Forestry and DEEP Property Management are working to resolve it.

4. **Boundary Conditions and total miles of boundary:** There are approximately three miles of boundary lines adjacent to private land. The rest of the boundary abuts Housatonic State Forest. These boundary lines can be confusing because although it is State Forest on both sides, there are different regulations for Centennial Watershed State Forest compared to Housatonic State Forest. These lines are marked with yellow paint, but the Centennial Watershed side has white rectangular signs with the logos of the three organizations that manage it (Aquarion, DEEP, and The Nature Conservancy), while the Housatonic side has the standard DEEP State Land tags.

   There are 1.8 miles along Wangum Road marked with Centennial Watershed State Forest signs. These signs have the logos of the three organizations that manage the Block and the words “Public Access by Permit Only”.

   All the boundaries were marked in 2016 and 2017.

5. **Known boundary problems:** There are no known problems.

6. **Restrictive Easements:** TNC has a conservation easement on the Class II and III land (owned by DEEP), and both TNC and DEEP have conservation easements on the Class I land. There are also restrictive covenants on the Improved Properties owned by AWC. DEEP Property Management has records of all the easements. Copies are also on file in the Pleasant Valley Field Office.

D. Special Use Areas

1. **Lakes and ponds:** Wangum Lake is owned by AWC. It is roughly 180 acres. The lake is a source of drinking water for the town of Norfolk. It is not open to the public for any purpose.

2. **Rivers and streams:** Wangum Lake Brook flows out from the south end of Wangum Lake for approximately 140 feet before flowing into private land and turning south alongside Stand 1-7. A small section of Roaring Brook flows out of an unnamed wetland and through Stand 1-12 for approximately 120 feet before emptying into Seldom Seen Pond. Several other unnamed streams are also present. One flows out from an unnamed wetland for approximately 200 feet and acts as the stand boundary between Stand 1-1 and Stand 1-55 before joining Wangum Lake Brook farther south. Beavers have constructed several dams along this stream, creating slow flowing pools closer to the wetland. Another unnamed stream flows out of an unnamed wetland through Stands 1-17 and 1-21 before emptying

into Wangum Lake. A final unnamed stream flows northwest away from the reservoir for approximately 170 feet before entering Housatonic State Forest.

3. **Cultural sites:** Charcoal mounds are scattered across the property. There are the remains of a collier hut in Stand 1-37. There is an old stone foundation in Stand 1-26 with a small adjoining field in Stand 1-28. There are also several stone walls, including one that acts as the boundary between Stands 1-28 and 1-32.

   Recreation and scenic sites – trails and signs: There is a Blue Trail (the Iron Trail) that runs along Old Town Road for approximately 5,800 feet northward from the intersection of Wangum Road and Canaan Mountain Road before turning west for another 2,000 feet and heading into Housatonic State Forest. The trail ends at the DEEP's Beckley Furnace Industrial Monument on Lower Road in Canaan. Unfortunately, the trail is muddy and severely eroded for much of its length because of illegal use by off-road vehicles. The trail is on Class III land so no recreational permit from the Department of Public Health is required.

   Volunteers from the Connecticut Forest and Park Association maintain the trail blazes and installed a small wooden sign on a tree at the Wangum Road trailhead.

   The Wildlife Division often issues an annual permit to disabled hunters to use ATVs on this trail to provide access to both the Wangum Lake Block and Housatonic State Forest.

   Wangum Road provides a pretty view of Wangum Lake as it winds around the southern edge of the reservoir. Immediately surrounding the lake is Class I land, owned by AWC, and there is no trespassing. There is no public access to Class I or II lands without a permit from the Aquarion Water Company, as per regulations of the Department of Public Health.

4. **Critical Habitat (State listed rare or endangered plants and animals)**

   A report from the DEEP Natural Diversity Database, dated October 9, 2020 is attached in the Appendix. The list of species that is referred to in the NDDB report has not been included to protect Threatened and Endangered Species.

5. **Natural Areas:** There are no Natural Area Preserves in the Block.

6. **Old Forestland Management Sites:** Stand 1-32 in the northeast corner of the block appears older than the rest of the surrounding forest. For example, there are many fallen logs with heavy moss covering them. For the purposes of ecological diversity it will be considered as an Old Forestland Management Site.

7. **Research Areas:** There are no active research areas on the Block. There is evidence of past study plots, such as metal stakes and small wire cages.

8. **Miscellaneous:** An underground water line runs from the treatment plant through the wetland toward Wangum Road.

E. Extensive Areas of Concern

1. **Wetlands:** There are several unnamed wetlands within the Block. The largest, approximately 89 acres, is located near the northwest corner and feeds an unnamed stream that is dammed by beavers, forming another 2-acre wetland. Stand 1-22 and 1-17 surround a 10-acre wetland that drains into the eastern side of Wangum Lake via an unnamed stream. A third unnamed wetland, approximately 13 acres (total divided between CWSF and Housatonic State Forest) and surround by Stands 1-19, 1-12, and Housatonic State Forest, is fed by Roaring Brook and drains into Seldom Seen Pond to the south.

Figure 2. Beaver pond in Stand 1-1.

2. **Vernal pools:** There is a vernal pool located in Stand 1-19.

3. **Unauthorized or illegal activity:** As mentioned earlier, there is illegal off-road activity on Old Town Road, as well as the other trails in the Block, causing mud holes and erosion. The gate on Old Town Road needs to be replaced with a standard DEEP metal pipe gate.

Figure 3. Old Town Road showing rutting from off-road vehicles.

F. Wildlife Habitat – DEEP Wildlife

1. **Landscape context:** The 1,242 acre Wangum Lake Block of Centennial Watershed State Forest is in the lightly developed northwest corner of Connecticut in the town of Canaan. Less than 5% of the town's landscape is developed (University of Connecticut CLEAR, 2015). This Block is adjacent to 3,200 acres of Housatonic State Forest, including the Canaan Mountain Wilderness Natural Area Preserve. Combined with approximately 6,000 acres of protected land at the nearby privately-owned Great Mountain Forest (GMF), and 1,638 acres of Robbins Swamp Wildlife Management Area (WMA), there are more than 10,000 acres of permanently protected land in this area. Forest fragmentation from roads, residential, and commercial development is limited compared to many other parts of Connecticut.

2. **Existing diversity:** This Block provides high quality forested habitat with limited fragmentation. It includes mature forests consisting of primarily hardwoods, mixed hardwood-softwoods, and softwood stands. Mast producing species are common, (i.e. oak, beech, black cherry) and conifers (hemlock and white pine) are widespread. There are forested wetlands, riparian areas, a beaver flowage, at least one vernal pool, a 4-acre reverting field, an open marsh, and the 180-acre reservoir. In general, a greater diversity of habitat types supports a greater number of wildlife species.

   A wide variety of wildlife could be expected to use this area, including wood frog, tree frog, red-backed salamander, weasel, fisher, beaver, bobcat, coyote, porcupine, white-tailed deer, black bear, red-eyed vireo, wood thrush, pileated woodpecker, barred owl, great horned owl, along with many more. Forestry Division staff have observed moose browsing, tracks, and scat. Moose are known to inhabit this region of the state.

   However, the majority of the forest is in the sawtimber size class, with less than 1% seedling size. Age class diversity at the landscape level is limited. Vertical structure within some stands is good (especially where past harvesting has occurred). In general, well developed vertical diversity within stands supports a greater array of bird species. Wildlife species associated with large areas of mature forest can thrive here, but conditions to support species requiring seedling-sapling forest is limited.

   Silviculture can be used to promote forest health and habitat diversity. Using even-aged and uneven-aged management systems over time, along with maintaining extensive areas of closed canopy forest, should create conditions required by interior breeding birds, while also making some areas of dense understory to enhance conditions for young forest species.

3. **New England Cottontail and American Woodcock Focus Areas: (See Map in Appendix D).** This Block is in the Upper Housatonic New England Cottontail (NEC) Focus Area and also the Connecticut Woodcock Focus Area.
   NEC Focus Areas were established using computer models that considered known and historic distributions of NEC's landscape features and the presence of protected lands.
   The Woodcock Focus Areas are identified by the Connecticut Wildlife Division and the Wildlife Management Institute as having the best potential for woodcock habitat also based on landscape

features and protected lands. Both NEC and woodcock require thick, shrubby, young forest habitat. Both species have declined significantly as young forest has declined across the region. Management that produces this kind of habitat should benefit these species along with more than 50 species of greatest conservation need.

The closest known NEC occurrence to this Block is over 1.2 miles away, north of Rt. 44. NEC generally don't disperse more than 0.6 miles. There was a known occurrence just south of this Block on Great Mountain Forest in 2006.

4. **Habitat Improvement Work:** No wildlife habitat enhancement work has occurred on this Block. However, in 2015, the Wildlife Division, in partnership with Great Mountain Forest, created approximately 19 acres of young forest habitat on GMF land by cutting down all mature forest except trees of exceptional wildlife value. This work was done immediately south of the Block on Wangum Road, along a stream corridor, next to mature conifer plantations that contained a mix of thick heavy grasses, broad-leaved plants, and mainly invasive shrubs. The Wildlife Division's Landowner Incentive Program funded the harvesting work and the landowner provided the match by mowing around the plantations to maintain field habitat.
   This habitat enhancement work was focused on improving conditions for NEC and woodcock. Unfortunately, NEC have not been redocumented in the area, but woodcock, ruffed grouse, and many other young forest species benefitted from the habitat created.

5. **Wildlife Based Recreation:** Hunting and trapping is allowed on Class III land (on the section west of Old Town Road) as shown in the annual DEEP Hunting and Trapping Guide. Birdwatching on the Class III land is allowed.

6. **Wildlife Recommendations:** Manage Stand 1-1, where ash is to be presalvaged, to promote young forest conditions to the extent possible. This stand is near wetland habitat and the young forest habitat created at Great Mountain Forest across the street.

   Promote the growth of young white pine seedling patches that provide nesting and escape cover for a wide variety of wildlife. In addition, cones from mature pines are a food source for small mammals and birds.

   If invasive exotic plants can be controlled, create larger log landings (up to 2 acres), which can serve as small herbaceous openings that provide soft mast (dewberry, black raspberry, and blackberry). Areas with bare soil can be planted with a conservation mix of native grasses, wildflowers, and/or pollinator mix. These areas can help improve the survival of turkey poults by providing seeds, tender herbaceous plants, and insects. The Wildlife Division can supply the seed and planting if necessary.

   Whenever possible, daylight patches of native, fruit producing shrubs, which provide important seasonal food for resident and migrating wildlife.

Treat invasive exotic plants where possible to promote native species.

In areas of planned selection harvests along and near wetland/riparian areas, cut as heavily as possible to promote seedling-sapling and shrubby, brushy growth to provide habitat and densely vegetated corridors for young forest species to disperse.

Follow established vernal pool protection measures during forestry operations.

The Wildlife Division will coordinate with the Forestry Division to periodically mow and mulch the 4 acres of reverting field in Stand 1-51 to keep it in an early successional stage, composed of grasses, broad-leaved plants, shrubs, and saplings.

G. Vegetative Condition

1. Forest size classes by forest type (total forest):

Table 2. Forest Size Classes by Forest Type on the Entire Forest *(acres)*

Forest Types	Size Classes				
	Seedling	Poletimber	Sawtimber	Nonforest	Total
Northern red oak	0	12	371	0	383
Mixed upland hardwoods	1	100	156	0	257
Eastern White pine/northern red oak/white ash	0	25	166	0	191
Red maple/lowlands/marsh	0	0	0	95	95
Eastern hemlock	0	0	69	0	69
Sugar maple/beech/yellow birch	0	20	17	0	37
Eastern White pine/Eastern hemlock	0	0	27	0	27
Grassland - cool season	0	0	0	4	4
Total	**1**	**157**	**806**	**99**	**1062**

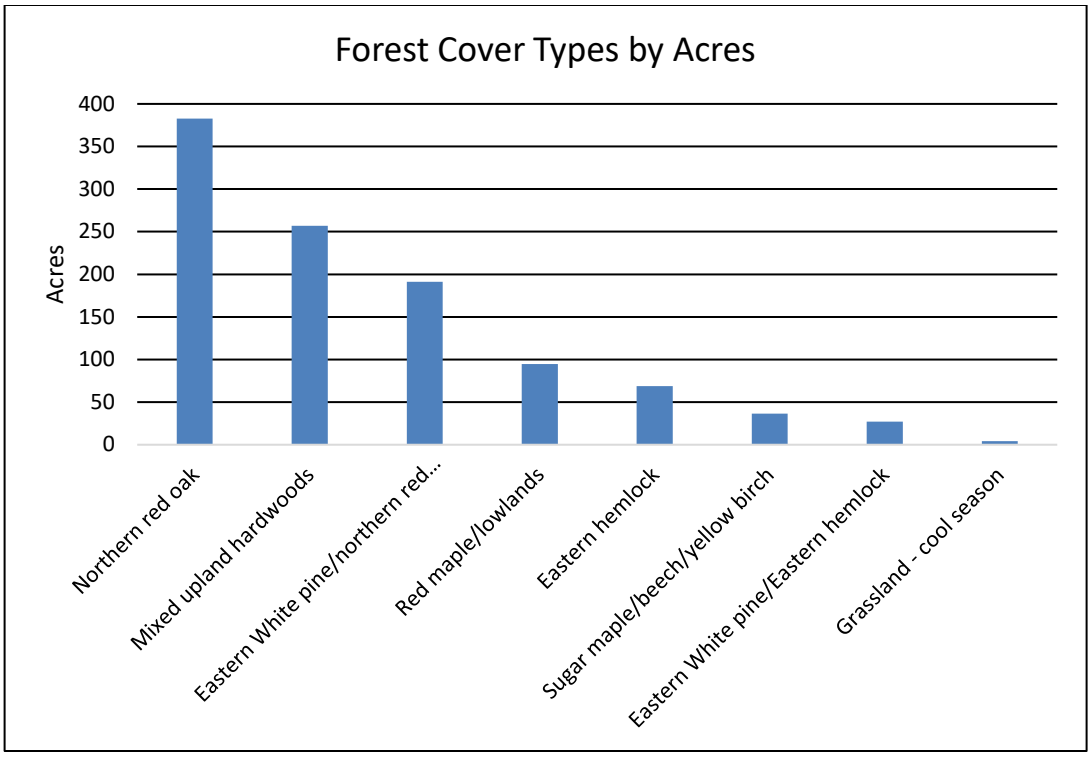

Figure 4. Forest Cover Types By Acres

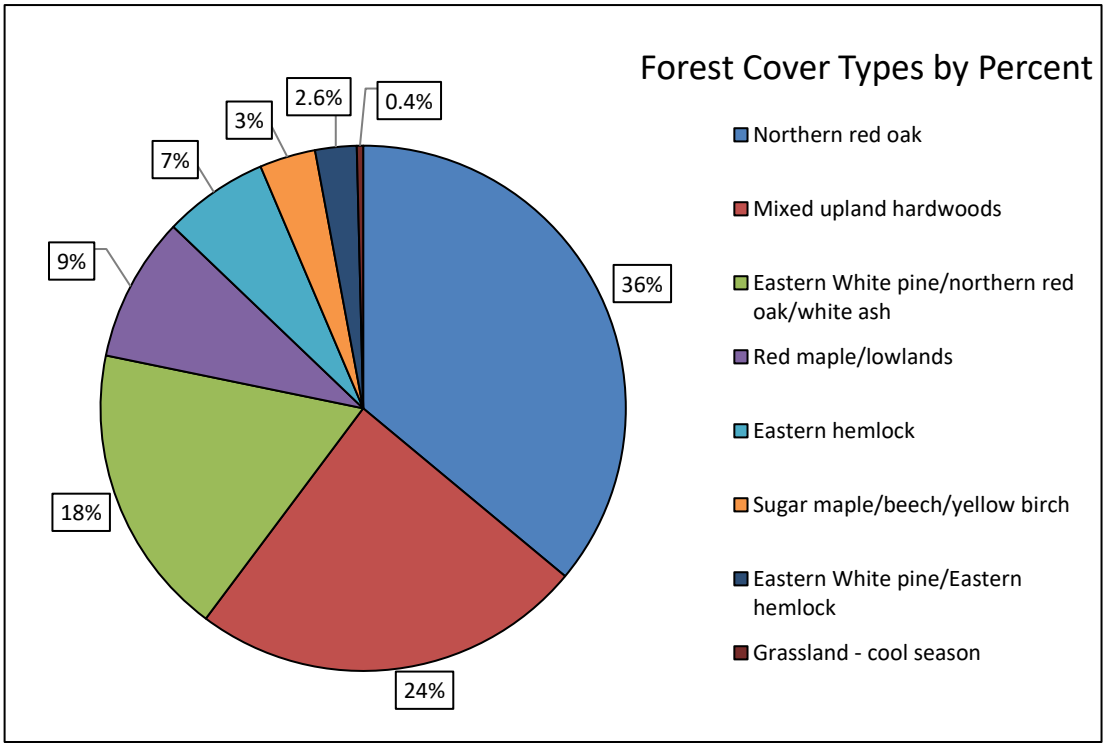

Figure 5. Forest Cover Types by Percentage

Table 3. Forest Cover Type, Size Class, and Condition Class on Areas to be Managed *(acres)*

Forest Cover Type	Selection Harvest	Thinning	TSI*	Allow to Grow	1st Shelterwood	Salvage	Total
Northern red oak							
Poletimber	0	12	0	0	0	0	12
Sawtimber	129	166	0	0	47	0	342
Mixed upland hardwoods							
Seedling	0	1	0	0	0	0	1
Poletimber	100	0	0	0	0	0	100
Sawtimber	96	0	0	0	0	43	139
Eastern white pine/northern red oak/white ash							
Poletimber	0	21	2	2	0	0	25
Sawtimber	43	123	0	0	0	0	166
Eastern hemlock							
Sawtimber	69	0	0	0	0	0	69
Eastern white pine/eastern hemlock							
Sawtimber	27	0	0	0	0	0	27
Sugar maple/beech/yellow birch							
Poletimber	20	0	0	0	0	0	20
Sawtimber	17	0	0	0	0	0	17
Total	499	324	2	2	47	43	917

Forest health: The health of the forest is being negatively impacted by non-native invasive plants. There are thickets of Japanese barberry, multiflora rose, honeysuckle, Oriental bittersweet and buckthorn. In the stands not overrun by invasive shrubs, the understory vegetation seems well-developed with an even distribution of most species, including oak. If a new invasive species threat arises, adjustments to the management plan will be made to preserve the overall health of the forest landscape.

There are exotic diseases (beech bark disease, for example) and insects (hemlock elongate scale, hemlock woolly adelgid, and soon, Emerald Ash Borer) found in and near the Block. Emerald Ash Borer

(EAB) was discovered in 2018 in Canaan. It is expected that within a few years, EAB will begin killing ash trees in the Block.

By managing the forest to provide a diverse mix of species and age classes, there will be more resiliency to future insects, pathogens, weather events and climate change.

Forest management, including timber harvesting, is consistent with the goals of promoting long-term carbon sequestration and storage. Younger, faster growing stands sequester carbon at a higher rate, while older stands store more carbon. Managing for complex forest structure, such as maintaining stocking of large trees while also providing growing space for younger trees can promote higher rates of stand-level carbon sequestration and storage.
In addition, the durable wood products resulting from the harvests in this plan will also store carbon for a long period of time.

H. Landscape Context – Forestry – adjacent land uses

1. The Wangum Lake Block provides 1,062 acres of protected forestland. It surrounds Wangum Lake, a drinking water reservoir, and several small patches of land owned by Aquarion Water Company. The Block is surrounded by 3,200 acres of Housatonic State Forest (including the Canaan Mt. Wilderness Natural Area Preserve) and the 6,000-acre Great Mountain Forest.

   The Canaan Mt. Wilderness Natural Area Preserve has a management plan that recommends minimal management. Great Mountain Forest is actively managed and has periodic timber harvests.

I. Desirable Land to Acquire

1. All of the land within the watershed of Wangum Lake is owned by DEEP or Aquarion. There is a parcel of private land between two portions of Housatonic State Forest to the north of Stand 1-35 that should be acquired if it becomes available. This would eliminate the owners from using Old Town Road to access their hunting cabin and help protect the condition of the road.

J. Public Involvement

1. A copy of this plan was sent to the Town of Canaan (Falls Village) Conservation Commission for review. They provided comments, mostly involving the maps. The maps and plan were revised accordingly.

2. Aquarion Water Company and The Nature Conservancy were sent copies of the Plan. It was on the agenda for the July 12, 2019 meeting of the Conservation Land Committee. Comments from the meeting were incorporated into the Plan.

3. The Great Mountain Forest was sent a copy of the plan. No comments were received.

K. Adaptive Management

1. The Division of Forestry understands forest management occurs as part of a dynamic landscape. Management actions are often affected by outside variables which influence the outcome of resource decisions. The Division of Forestry reserves the right to reasonably change our management approach as environmental change and resource needs warrant. Some of these changes may be associated with biological factors such as insects and disease, or population outbreaks. Increased unauthorized motorized recreation which erodes trails and roads may require action unforeseen during the composition of this plan. Additionally, environmental conditions such as hurricanes or record-breaking precipitation may additionally affect resource condition and work requirements. The Division of Forestry and our colleagues in Parks, Wildlife, Fisheries, and Agency Support, evaluate circumstances and use an adaptive-management philosophy and additionally reserve the right to address unforeseen circumstances should they arise during the tenure of this forest management plan.

L. 10 Year Goals

1. The forest has been evaluated and categorized into groups affected by current physical conditions, policy, or management principles.

2. **Objectives:**

   - Continued high-quality drinking water protection
   - Create and maintain a more uneven, resilient, and diverse forest structure (and wildlife habitats therein) by:
     (1) Implementing a sustainable timber management program
     (2) Creating a mix of hardwood, mixed hardwood-softwood, and softwood stands
     (3) Protecting critical habitat areas designated by NDDB
   - Control/remove non-native invasive plants to allow forest regeneration and better protect diversity of native species
   - Manage for invasive forest insects and diseases by
     (1) Presalvaging stands/species in danger of imminent mortality
     (2) Encouraging vigorous individual trees of threatened species to grow and regenerate, improving the genetic stock of that species
   - Improve access by rehabilitating forest roads that have deteriorated

3. **Uneven-aged management:** 543 acres will be managed on an uneven-aged basis (59% of the total actively managed area).

In uneven-aged management, timber harvests will use single tree and group selection to open small openings (< 1 acre) in the canopy, allowing shade intolerant species, such as paper birch or northern red oak, to regenerate while also maintaining the presence of shade tolerant species, such as sugar maple or beech. This will increase overall stand diversity via differentiating age, size class, and species.

Roughly 33% of the basal area (and approximately 33% of the timber volume) in a given stand will be removed with each harvest, to be repeated on a 20-year cutting cycle. Roughly 20% of each area cut will be regenerated with each 20-year harvest.

543 acres/20-year rotation results in 27 acres harvested on average per year (270 acres every 10 years).

Additionally, stand 1-32 will be classified as an Old Forestland Management Site because of its unique features. The 29 acres will not count toward the uneven-aged management quota for this management plan.

Even-aged management: 370 acres will eventually be managed on an even-aged basis (40% of the total actively managed area).

In even-aged management, a 100-year cutting rotation will be used. This may include pre-commercial thinning, overstory thinning, seed tree, clearcut, and first and second stage shelterwood harvests. At the end of the rotation, the entire overstory is removed to provide full sunlight to the forest floor, stimulating the growth of shade intolerant species such as oak, birch, and tulip poplar. In even-aged management, during the course of the rotation, intermediate treatments such as thinning are used to improve stand composition and tree spacing. Thinning in overstocked stands (relative density over 80%) will provide optimum growing space for the better quality trees.

370 acres/100-year rotation results in 3.7 acres regenerated per year (37 acres every 10 years).

However, no even-aged regeneration harvests will be planned until the non-native invasive shrubs have been controlled.

M. Work Plans

Uneven-aged Management

Acres	Stand	Prescription
43	1-1	Pre-Salvage White Ash
35	1-31	Selection Harvest
9	1-46	Selection Harvest
17	1-47	Selection Harvest
55	1-48	Selection Harvest
18	1-49	Selection Harvest
13	1-50	Selection Harvest
17	1-52	Selection Harvest
20	1-55	Selection Harvest
5	1-56	Selection Harvest
232		

- *There is the opportunity to combine harvests in the Wangum Lake Block with adjacent portions of Housatonic State Forest. For example, an ash presalvage could be done simultaneously.*

Invasive Species Control

Stands 1-1, 1-55, 1-43, 1-44, 1-8 – treat understory exotic invasive plants. Also control will be needed in the adjacent Housatonic State Forest. *(NOTE: 71 acres were treated for invasives in Stands 1-1 and 1-55 in 2018).*

Road Improvements: Improve Old Town Road

Old Town Road is badly rutted and eroded. It needs extensive work, including geotextile and processed aggregate for approximately one mile north along the western side of the Block. It also requires a stream crossing, either by bridge, culvert, or ford. DEEP Fisheries will be consulted. Landings will have to be built at several places along the road for particular harvests. The Timber Harvest Revolving Fund could be used for this work. In addition, because the road is also a Blue Trail, perhaps Recreational Trails Grants could be used.

- Maintain boulder barriers next to the gate at the entrance to the Old Town Road to deter ATV or other motor vehicle users from entering the forest.
- Replace the existing farm gate with a more substantial metal pipe gate.

Other Work:

- Before any harvest, the sale area will be evaluated for non-native invasive plants and treated appropriately (in addition to stands specifically listed under 'Invasive Species Control' above)
- Additional hunting areas could include Class III and Class II land east of Old Town Road. This would require a Hunting Review Team report and approval by the Conservation Land Committee. It would also require that the hunting boundaries be posted by the Wildlife Division.
- All recreational activities on Class I and Class II lands, including hunting, would require Aquarion Water Company to apply for a permit from the Connecticut Department of Public Health.

Appendix A: References

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MA DCR, Snowman, etal. 2007. 2007-2017 Land Management Plan for the Quabbin Reservoir Watershed System, Massachusetts Department of Conservation and Recreation, Division of Water Supply Protection.

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Roach, Benjamin, and S. Gingrich. Dec. 1968. Even-Aged Silviculture for Upland Central Hardwoods,. Agriculture Handbook 355, US Forest Service.

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Appendix B: Glossary

This glossary contains a list of commonly used forestry terms.

Size Classes

- **Sawtimber –** Hardwood trees 12-inch dbh (diameter breast height or 4.5 feet off the ground) and larger, and softwood trees 10-inch dbh and larger, that contain at least one 8-foot sawlog.
- **Poletimber –** Hardwood trees between 5 and 11 inches dbh and softwood trees 5 to 9 inches dbh. These trees are too small for sawlogs, but could be sold as pulpwood, fuelwood, or other small products where such markets exist.
- **Saplings –** Trees 1 to 5 inches dbh.
- **Seedlings –** Trees less than 1 inch dbh.
- **Stand –** An area of trees of a certain species composition (cover/IV type), age/size class distribution, and condition (quality, vigor, risk), usually growing on a fairly homogeneous site.

An **even-aged** stand contains trees in the main canopy that are within 20 years of being the same age.

An **uneven-aged** stand contains trees of several 15-20 year age classes.

Types of Silvicultural Treatments

- **Clearcut –** Used in even-aged management to regenerate a new forest using seeds already in the soil, seeds brought in from adjacent areas via wind or animals, and/or sprouts from stumps. All stems are removed to provide maximum sunlight for the new forest. Trees such as black cherry, yellow poplar, aspen, and paper birch often regenerate after clearcuts. Often used to create early successional wildlife habitat.
- **Selection harvest –** Used in uneven-aged management. Trees are removed singly or in small groups up to an acre in size, maintaining a fairly continuous canopy. Selection harvests tend to favor trees that can grow in partial shade such as sugar and red maples, black and yellow birch, beech, and hemlock.
- **Single-tree selection** – An uneven-aged Silvicultural technique involving the removal of trees singly or in groups of 2 or 3, which maintains a continuous canopy and an uneven-aged or uneven-sized misture.
- **Group selection** – An uneven-aged Silvicultural technique involving the removal of trees in groups usually 1/10 to 2/3 acre in size, but sometimes up to 1 or 2 acres on large properties. Group selection can be applied in combination with single-tree selection to create a more varied landscape.
- **Shelterwood** – Used in even-aged management. Understory and lower crown canopy trees are removed to allow the new stand to regenerate in partial sunlight. Trees to be retained are usually of the best quality to serve as a desirable source of seed and improve the genetic stock of the forest. After adequate regeneration is established, the overstory is removed in one or two cuts. Shelterwoods are often used to regenerate species such as oak and white pine that have irregular crops of seed and gain an advantage over other species when regenerating in partial shade.

- **Thinning –** The removal of some trees to enhance the vigor and growth of other trees without intentionally regenerating the stand. Allows for the removal of undesirable trees either due to genetic quality, disease, or potential mortality.
- **Seed Tree –** An even-aged Silvicultural technique similar to a clearcut, but leaves several residual trees per acre to provide a seed source of the species you are trying to regenerate (i.e. oak).

Definitions

- **Age class –** The trees in a stand that became established at, or around, the same time. The range of tree ages in a single age class is usually less than 20 percent of the expected age of that class.
- **Basal area –** The cross sectional area of a tree's stem at 4.5 feet above the ground, or breast height. Basal area per acre is often used as a stand metric to determine stand stocking and density.
- **Best Management Practices –** Procedures and treatments that lessen soil erosion, sedimentation, stream warming, movement of nutrients, and visual quality during or following forest management activities.
- **Biological diversity –** The variety and abundance of species, their genetic composition, and the communities, ecosystems, and landscapes in which they occur. Al.so, the variety of ecological structures and functions at any one of these levels.
- **Board-foot volume –** The volume of wood expressed as the number of boards 1x1 foot and 1 inch thick
- **Carbon sequestration –** The process of removing carbon from the atmosphere for use in photosynthesis, resulting in the maintenance and growth of plants and trees. The rate (or amount and speed) at which a forest sequesters carbon changes over time. In the northeastern United States, carbon sequestration (rates) typically peak when forests are young to intermediate in age (around 30-70 years old), but they continue to sequester carbon through their entire life span.
- **Carbon storage –** The amount of carbon that is retained in a carbon pool within the forest. Storage levels increase with forest age and typically peak in the northeastern United States when forests are old (>200 years).
- **Mature tree –** A tree that has reached biological maturity shows declining year-to-year volume growth.
- **Native plant –** A species that naturally occurs in a given location where its requirements for light, warmth, moisture, shelter, and nutrients are met.
- **Non-commercial treatment** – Any forest management activity that does not produce enough revenue to pay for the costs associated with the treatment.
- **Nutrient** – Elements and other chemical substances that support biological activity (i.e. Nitrogen, phosphorus, potassium, sulfur, etc.)
- **Old Growth** – A forest community that has remained undisturbed by man for a long period of time, the length of which is relative and dependent upon locality.
- **Overland flow** – The portion of rain or snowmelt that flows over the surface of the soil until it reaches a stream channel. It is not absorbed by the soil. Overland flow in forests is rare unless leaf litter and organic horizons of the soil have been severely disturbed or mineral soils have been compacted.

- **Patch** – A patch is a relatively homogeneous area that differs in some way from its surroundings (e.g., woodlot in a corn field, conifer plantation in a mixed-deciduous forest).
- **Peak water flow** – The instantaneous maximum flow of water, often occurring as the result of an intense storm, snowmelt, or a combination of both.
- **Plantation** – A forest stand in which most trees are planted. Typically, planted trees are in rows with equal spacing between each tree.
- **Regeneration cuttings** – Silvicultural cuttings designed to naturally regenerate the stand by providing for seedling or stump sprout establishment.
- **Relative Density** – An index of crowding in forest stands, also called the tree-area ratio; a measure of the absolute stand density expressed as a ratio to the density of some reference level. The reference level is usually the stand density of a fully stocked stand for a particular species composition, site, and method of treatment.
- **Sedimentation** – The accumulation of organic and mineral soil particles and rocks in streams and water bodies due to erosion. Sedimentation often accompanies flooding. The application of Best Management Practices will help protect against sedimentation during and after treatments.
- **Seed tree** – A tree that produces seed. Seed trees are usually mature and of acceptable quality.
- **Shade intolerance** – The relative inability of a plant to become established and grow in shade.
- **Shade tolerance** – The relative ability of a plant to become established and grow in shade.
- **Silviculture** – The art, science, and practice of establishing, tending, and reproducing forest stands with desired characteristics.
- **Species diversity** – The number of different plants, animals, and other life forms coexisting in a community.
- **Stand condition** – The relative number, size, species, quality, and vigor of trees in a forest stand
- **Stand density** – A quantitative measure of the proportion of area in a stand occupied by trees such as basal area or trees per acre.
- **Stocking** – A subjective indication of stand density that helps determine whether the stand needs to grow further, be thinned, or regenerated
- **Sustainable** – The indefinite and steady supply of something
- **Understory** – The saplings, shrubs, seedlings, and other vegetation growing beneath the forest canopy and above the herbaceous plants on the forest floor.
- **Vertical diversity** – The extent to which plants are layered within an area. The degree of layering is determined by two factors: 1.The arrangement of different growth forms (trees, shrubs, vines, herbs, mosses, and lichens); 2. The distribution of different tree and shrub species having different heights and crown characteristics
- **Water quality and quantity –** A category of factors associated with forests that include intensive protection of water quality, riparian areas, wetlands, and fisheries.
- **Water yield –** The distribution and total quantity of runoff, usually considered over some specified period of time. Water yield may be characterized by total volume of runoff and flow duration curves.
- **Watershed –** An area of land through which precipitation is redistributed into components of the hydrologic cycle, including evaporation, groundwater, and streamflow. A watershed is all the land

giving rise to streamflow at a selected point in a stream channel; the area drained by a river or stream and its tributaries.

- **Wetland –** In the absence of a single, universally recognized definition, a wetland is a land/water ecosystem characterized by periodic inundation. The soils are developed under the influence of saturation. It supports plants and animals adapted to these conditions.

Appendix C: Natural Diversity Database Report

Connecticut Department of
ENERGY &
ENVIRONMENTAL
PROTECTION

October 9, 2020

Gerard Milne
CT Department of Energy & Environmental Protection
Bureau of Natural Resources-Division of Forestry
P.O. Box 161
Pleasant Valley, CT 06063
kyle.arvisais@ct.gov

Project: 10-year Forest Management Plan for the Centennial Watershed State Forest, Wangum Road, Canaan, Connecticut
NDDB Preliminary Assessment No.: 202012029

Dear Gerard Milne,

I have reviewed Natural Diversity Data Base maps and files regarding the area delineated on the map provided for the 10-year forest management plan for the Centennial Watershed State Forest, Wangum Road, Canaan, Connecticut.

According to our records there are known extant populations of State Listed Species known that occur within or close to the boundaries of this property. I have attached a list of these species to this letter. This letter is valid for one year from the date of this letter.

Natural Diversity Data Base information includes all information regarding critical biological resources available to us at the time of the request. This information is a compilation of data collected over the years by the Department of Energy and Environmental Protection's Natural History Survey and cooperating units of DEEP, private conservation groups and the scientific community. This information is not necessarily the result of comprehensive or site-specific field investigations. Consultations with the Data Base should not be substitutes for on-site surveys required for environmental assessments. Current research projects and new contributors continue to identify additional populations of species and locations of habitats of concern, as well as, enhance existing data. Such new information is incorporated into the Data Base as it becomes available. The result of this review does not preclude the possibility that listed species may be encountered on site and that additional action may be necessary to remain in compliance with certain state permits.

Please contact me if you have further questions at (860) 424-3592, or dawn.mckay@ct.gov . Thank you for consulting the Natural Diversity Data Base.
Sincerely,

Dawn M. McKay

Dawn M. McKay
Environmental Analyst 3

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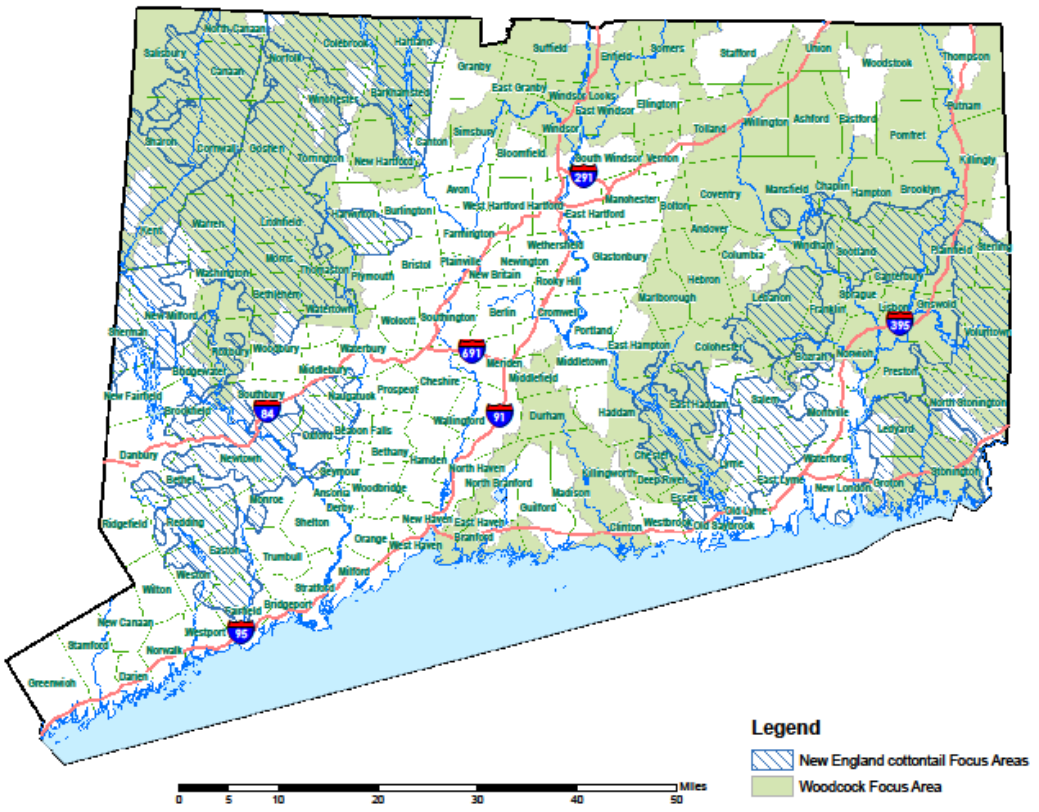
Appendix D: New England Cottontail and Woodcock Focus Areas Map



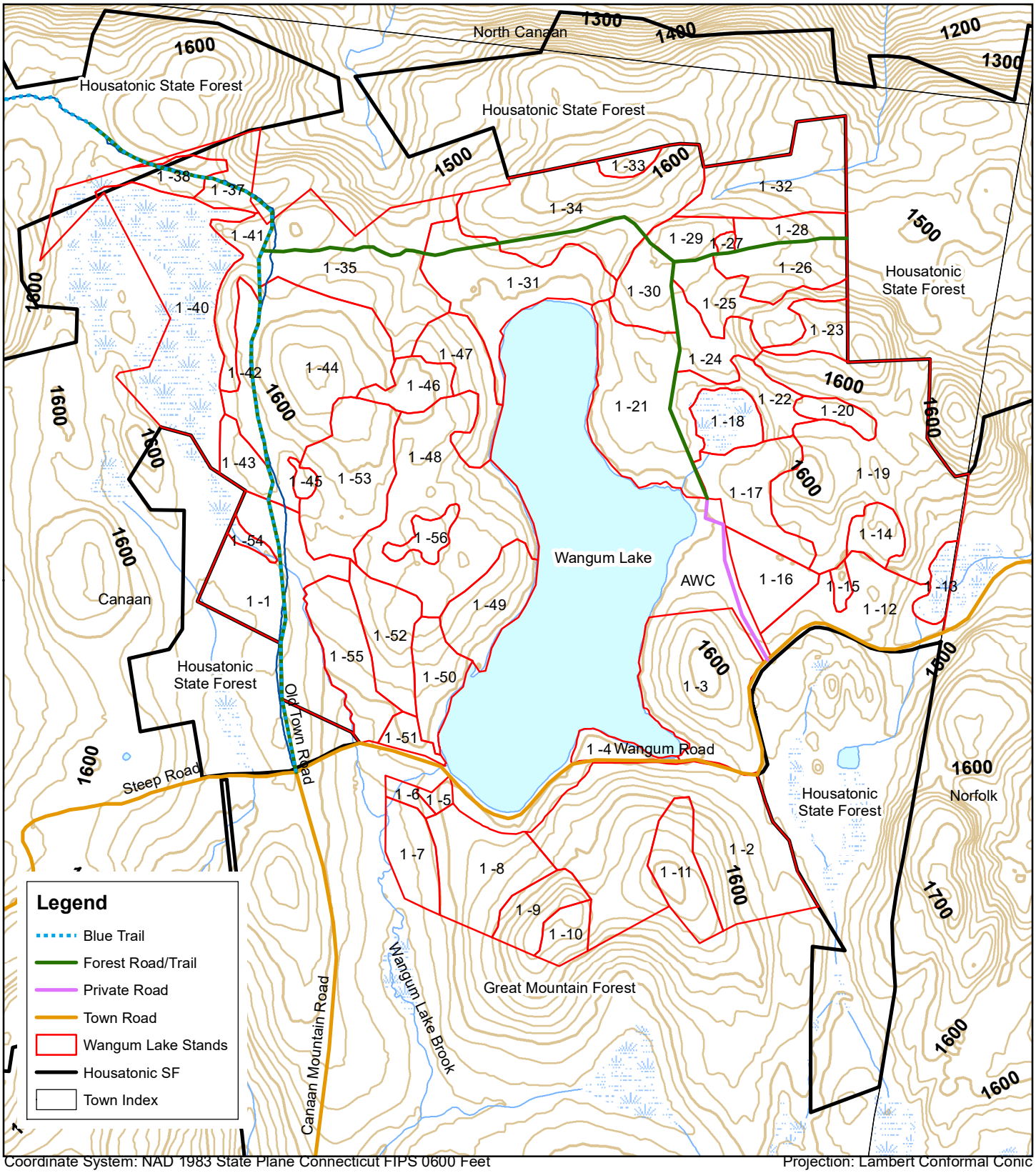
Map A - Topographic
Wangum Lake Block - Centennial Watershed State Forest

Canaan, Connecticut
1,242 Acres

October 2020

Map Scale: 1:18,000

0 750 1,500 3,000 Feet



Coordinate System: NAD 1983 State Plane Connecticut FIPS 0600 Feet

Projection: Lambert Conformal Conic

Map B - Base Map
Wangum Lake Block - Centennial Watershed State Forest

Canaan, Connecticut
1,242 Acres

October 2020

Map Scale: 1:18,000

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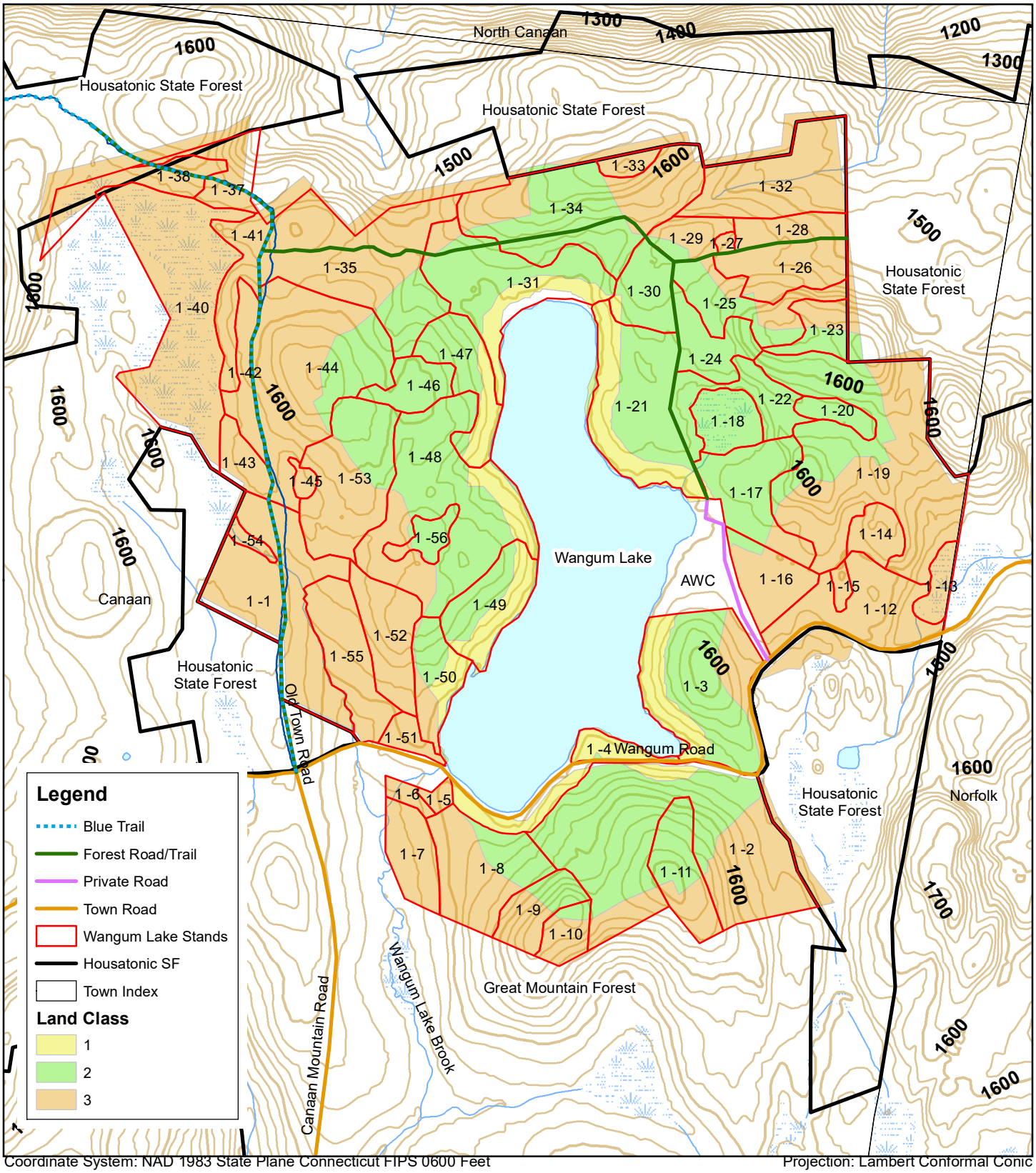


Coordinate System: NAD 1983 State Plane Connecticut FIPS 0600 Feet

Projection: Lambert Conformal Conic

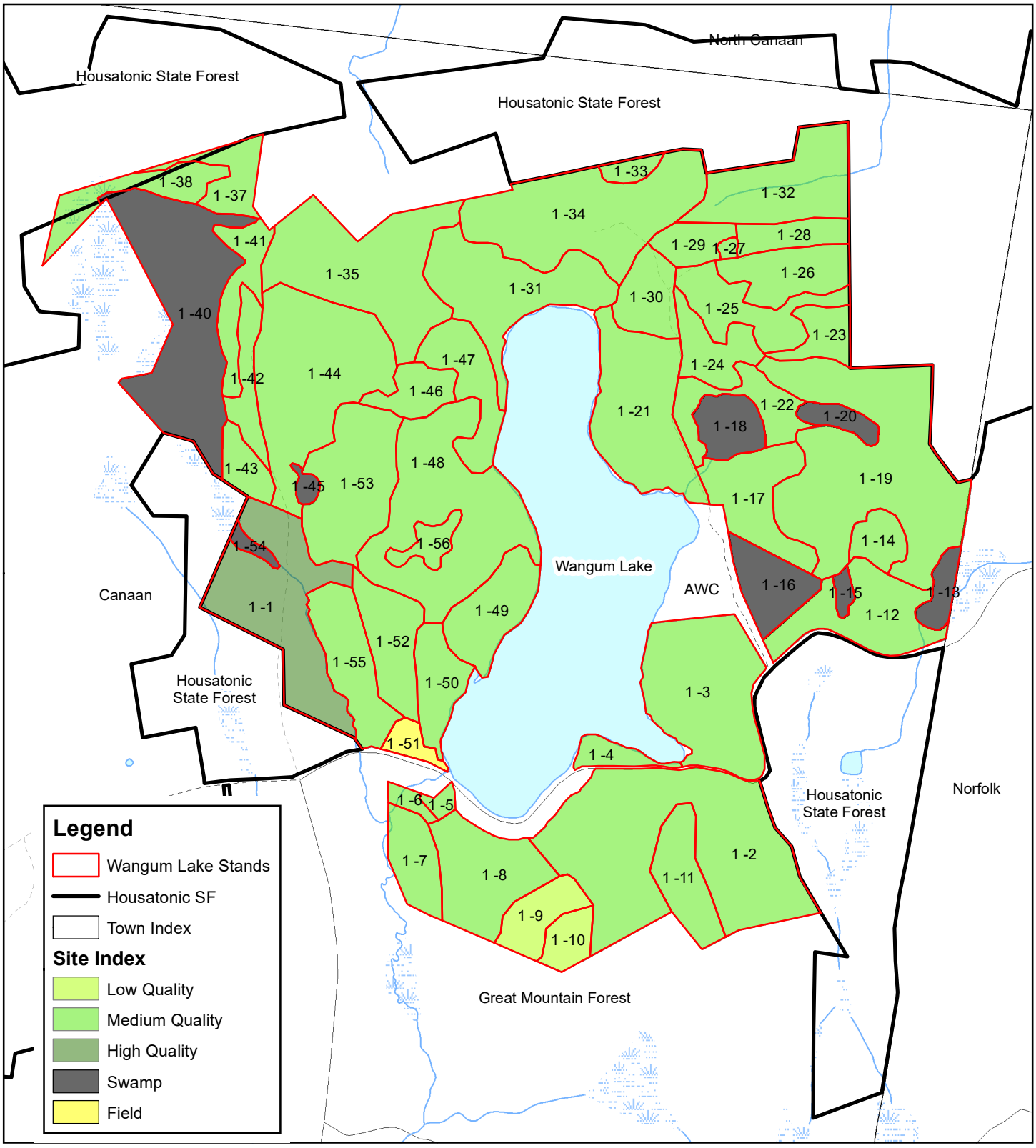
Map C - Site Quality
Wangum Lake Block - Centennial Watershed State Forest

Canaan, Connecticut
1,242 Acres

October 2020

Map Scale: 1:18,000

0 750 1,500 3,000 Feet



Coordinate System: NAD 1983 State Plane Connecticut FIPS 0600 Feet

Projection: Lambert Conformal Conic

Map D - Forest Type & Size Class
Wangum Lake Block - Centennial Watershed State Forest

Canaan, Connecticut
1,242 Acres

October 2020

Map Scale: 1: 18,000

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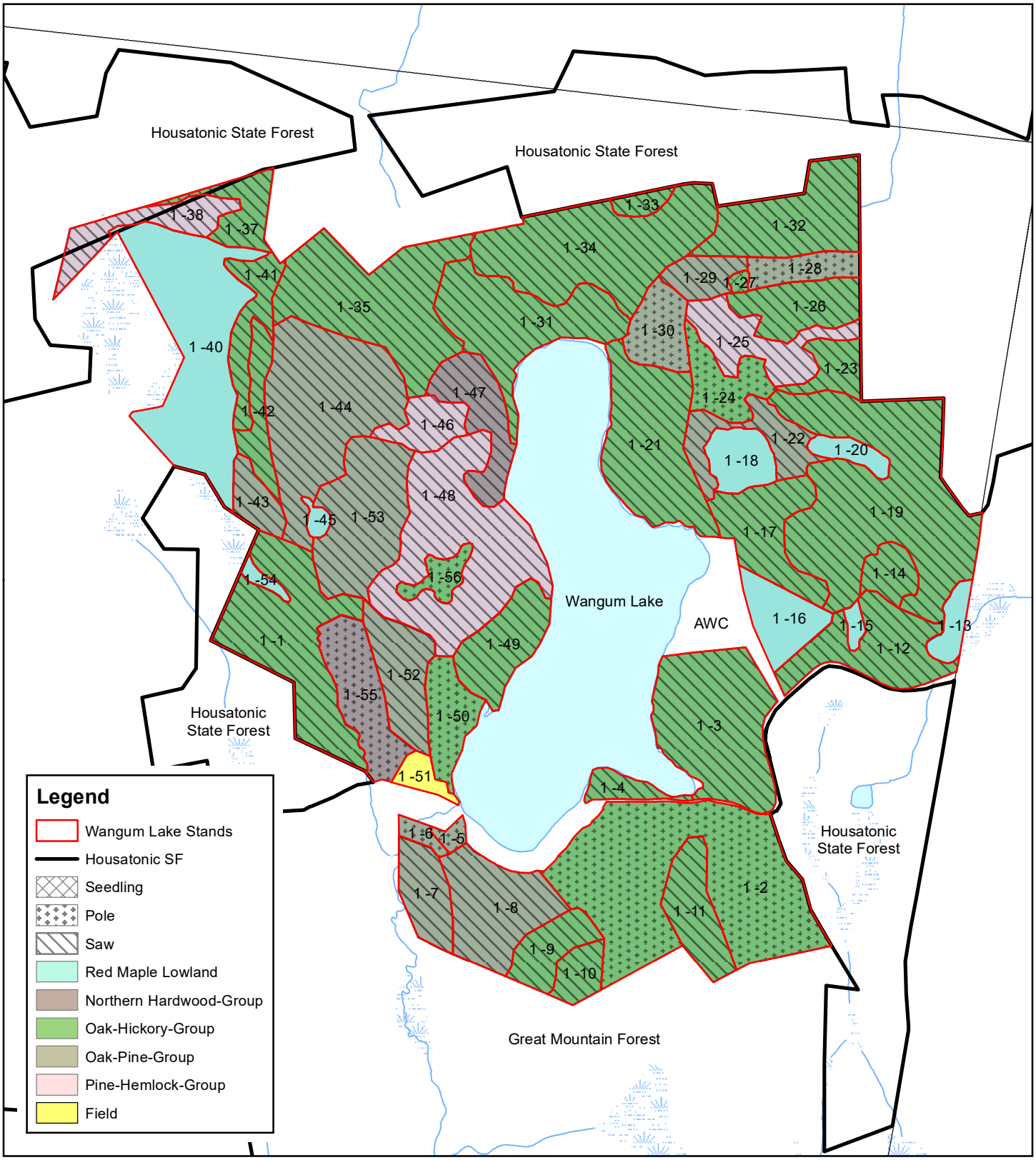

Coordinate System: NAD 1983 State Plane Connecticut FIPS 0600 Feet

Projection: Lambert Conformal Conic

Map E - Special Features
Wangum Lake Block - Centennial Watershed State Forest

Canaan, Connecticut
1,242 Acres

October 2020

Map Scale: 1: 18,000

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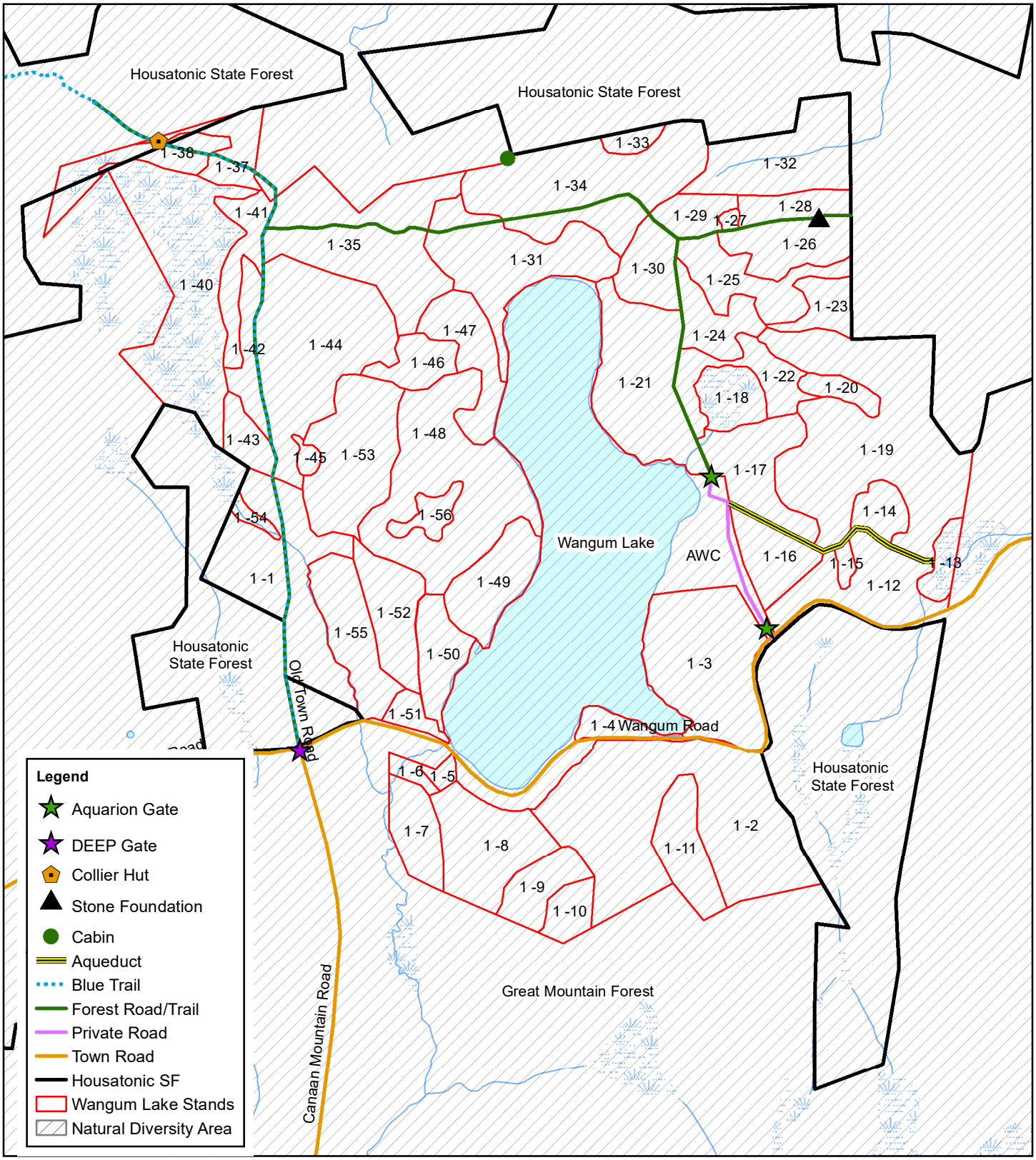

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Projection: Lambert Conformal Conic

Map F - Work Plan
Wangum Lake Block - Centennial Watershed State Forest

Canaan, Connecticut
1,242 Acres

October 2020

Map Scale: 1:18,000

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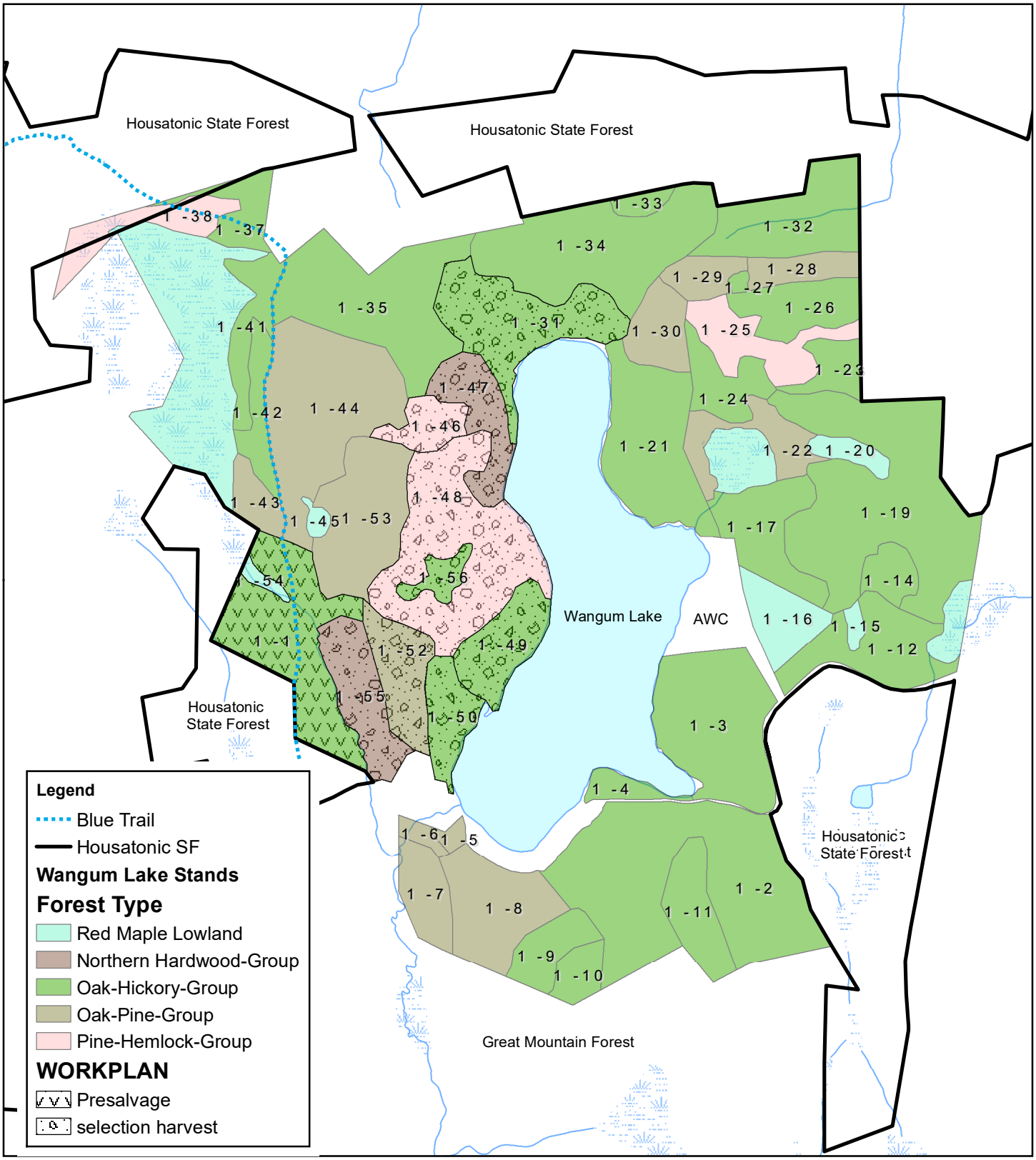

Legend

- Blue Trail
- Housatonic SF

Wangum Lake Stands

Forest Type

- Red Maple Lowland
- Northern Hardwood-Group
- Oak-Hickory-Group
- Oak-Pine-Group
- Pine-Hemlock-Group

WORKPLAN

- Presalvage
- selection harvest

Coordinate System: NAD 1983 State Plane Connecticut FIPS 0600 Feet

Projection: Lambert Conformal Conic